evenly convex, considerably broader than the head; the three succeeding segments are of about the same length, and each are about half as long as the fifth and succeeding segments. On the first segment are about ten bead-like tubercles seen from above; on the third about eight longer tubercles can be seen from above; on the fifth and succeeding segments there are about nine dorsal and subdorsal high, prominent, thick, parallel ridges, becoming sharp behind. On the middle segments of the body about six sharp ridges with broad hollow valleys between can be seen from above. These are mounted on each side lower down by about twelve less distinct ridges, becoming towards the lower edge of the scuta less and less convex and distinct, until they are indicated by simple impressed lines. There are thus about thirty ridges in all on each scute. The segments (arthromeres) are short, and the smooth spaces between the rigid portions are very short above. The color of the body is horn-brown, the head, feet and antennæ pale flesh-colored, and there is a dark median spot on the vertex between the eyes. The ridges are darker than the rest of the body. Length 30^{mm}.

Little Wyandotte cave, Indiana; and Cave of Fountains next to Weyer's cave, Virginia (Packard), Zwingler's cave, Carter's cave, Kentucky (F. G. Sanborn). Spruce Run cave in the Kanawha river, Giles Co., Va. (Cope). One of the most abundant of the Myriopoda in the mountain region of Tennessee and North Carolina (Cope).

This species is not unfrequently found in caverns, where *L. lactarium* more rarely occurs. This well-marked species may readily be distinguished from *Lysiopetalum lactarium* by the very short, thick antennæ, linear eyes, and by the slenderer body, which, however, ends much more obtusely. We know of but one other species of Julidæ with the eyes arranged in a linear series; this is the *Trachyjulus ceylonicus* Peters of Ceylon, figured by Humbert.

The cave specimens which we have found are partially bleached, the result of probably a limited number of generations in the darkness.

On the Morphology of the Myriopoda. By A. S. Packard, Jr.

(*Read before the American Philosophical Society, June 16, 1883.*)

The following notes have reference to the hard parts especially of the diplopod Myriopods:

The Head. In the Chilognaths, which are the more primitive and in some respects the lowest group of the sub-class, the Pauropoda excepted, the structure of the head is on a much simpler type than in the Chilopoda.

The epicranium constitutes the larger part of the head; it may be regarded as the homologue of that of hexapodous insects. Of the clypeus of Hexapoda there is apparently no true homologue in Myriopods; in the Lysiopetalid Chilognaths there is, however, an interantennal clypeal re-

gion slightly differentiated from the epicranium and forming the front of the head. In the Chilopods there is no well-marked clypeus; only a short, narrow transverse preantennal clypeal region to which the labrum is attached. Meinert, in his valuable and pains-taking work on Myriopods designates what we here call the epicranium, the *lamina cephalica;* the division sometimes indicated in front next to the antennæ, he calls *lamina frontalis discreta.*

The labrum in the Chilognaths is a short, but broad, sclerite, very persistent in form, and not affording family or generic characters; it is emarginate on the sides, with a deep median notch containing three acute teeth. The labrum may on the whole be regarded as homologous with that of the Hexapoda, but is very broad and is immovable. Very different is the so-called labrum of the Chilognaths, in which it consists of two parts, a central portion which may be homologized with the labrum of the Chilognaths, but is narrower, with a deep broad median notch at the bottom of which is a central stout tooth.

In *Orya barbarica* Gerv., according to Meinert, the labrum has a median suture, dividing it into two pieces, each with numerous fine teeth on the outer edge.

In *Dignathon microcephalum* Lucas (Meinert. Tab. ii, fig. 15), and in *Geophilus sodalis* Bgs. and Mein., Meinert figures and describes the labrum as consisting of *pars media* and two *partes laterales,* distinctly separated by suture; no such differentiation as this is known to us as occurring in the labrum of Hexapods.

This labrum is flanked on each side by a transverse sclerite, much broader than long; these pieces may be called the *epilabra;* to the outer edge of each is attached the cardo of the so-called mandible (*protomala*). What we have for brevity called the *epilabra* (fig. 1) are the "laminæ fulcientes labri" of Meinert.*

The so-called mandibles of the Myriopods are the morphological equivalents of those of insects, but structurally they are not homologous with them, but rather resemble the lacinia of the hexapodous maxilla. For this reason we propose the term *protomala* (*mala,* mandible) for the mandible of a myriopod; *mala* would be preferable, but this has already been applied by Schiödte to the inner lobes of the maxilla of certain Coleopterous larvæ.

The protomala consists of two portions, the *cardo* and *stipes,* while the hexapodous mandible is invariably composed of but one piece, to which the muscles are directly attached, and which corresponds to the stipes of the myriopodous protomala. The stipes instead of being simply toothed, or with a plain cutting edge, as in Hexapoda, has, in the Chilognaths, two

* Myriapoda Musaei Haurinensis. Bidrag til Myriapodernes Morphologi og Systematik. Ved Fr. Meinert, af "Naturhistorisk Tidsskrift," 3 R. 7 B., Kjöbenhavn, 1871, p. 105. See Tab. i, fig. 4. Meinert states that the laminæ fulcientes do not belong to the labrum itself, and that the form of these pieces varies greatly according to the species.

outer unequal long teeth; and within, a series of singular processes like stout setæ edged with dense spines on the inner side. This double apparatus of teeth and spinose processes, which may be called the *pectinella*, gives the stipes a decided resemblance to that of the hexapodous maxilla. In the Chilopoda, according to the figures and description of Meinert, there is a greater variation in the nature of the pectinella of the stipes. As we have observed in the protomala of Scolopendra and Lithobius, there are three or more stout teeth, with an inner series of spinulated slender processes; but in several genera figured by Meinert, as *Mesocanthus albus* Mein., *Scolioplanes crassipes* Koch, *Chætechelyne vesuviana* Newp., *Geophilus sodalis* Bgs. and Mein., and *Mecistocephalus punctifrons* Newp., the cutting edge is provided with spinose processes alone.

For the second pair of mouth appendages of the Myriopoda we propose the term *deutomala*, or second pair of jaws. They form the so-called labium of Savigny and later authors. In the Chilognaths they have a superficial resemblance to the labium of winged insects; but the corresponding pair of appendages in Chilopoda are not only unlike the labium of Hexapoda, but entirely different in structure from the homologous parts in Chilognaths. The "labium" of Newport, or first maxillæ of Meinert, have been described and figured by those authors, to whose works the reader is referred.

The following remarks apply to the homologues of these parts in the Chilognaths. While most authors designate this pair of appendages as the "labium," Meinert more correctly calls them the first maxillæ, briefly in the Latin abstract of his "Danmark's Chilognather"* in his diagnosis of the order describing them as "*Stipites maxillares* appendicibus instructi, detecti;" but in his description of Julus referring to them as "Lamina labialis parva, stipites labiales modo partim sejungens."

Meinert also describes what he designates as a third pair of mouth-parts, or *labium*, which is enclosed by the second pair, behind which is a triangular plate (*lamina labialis*) which he regards as a sternal part, corresponding to the mentum of insects. He then adds: "In front of the labium in the Polydesmidæ are two short round styles (*stili linguales*), which are toothed at the end." He also speaks of the curved piece behind the laminia labialis, which he designates as the *hypostoma* (see our fig. 2).

It should be observed that Savigny states that the labium (lèvre inférieure) is in Julus composed of what he designates as the first and second maxillæ; his second maxillæ being Meinert's *labium*.

It seems to us that the researches of Metschnikoff† on the embryology of the Chilognaths (Strongylosoma, Polydesmus and Julus) leave no doubt that these myriopods have but two pairs of mouth-appendages, which Metschnikoff designates as mandibles and labium. The latter arises as a pair of tubercles or buds, at first of exactly the form of the man-

* Naturhistorisk Tidsskrift. 3 R. 5 B.

† Embryologie der doppeltfussigen Myriapoden (Chilognatha), Von Elias Metschnikoff. Zeitschrift für Wissenschaft. Zoologie, xxiv, 253, 1874.

dibles, and like the primitive embryonic mouth-appendages of any arthropod. Hence the differentiations of parts and coalescence of the two limbs, while closely resembling that of the labium or second maxillæ of hexapods, really occur in Myriopods in a different pair of appendages, *i. e.*, the second instead of the third pair. Hence the parts called labium (many authors) in Myriopods are really homologous with the first maxillæ of insects ; and they should, to prevent misconception, receive a distinctive name (deutomalæ). With the aid, then, of embryology we have arrived at a clearer conception of the homologies of the second pair of mouth-appendages in the Chilognaths. It forms a broad flat plate, becoming the floor of the mouth, and forming an under lip ; it is differentiated into two sets of broad plates, an outer and inner stipes ; the outer stipes (*stipes exterior*) bears at the free edge two movable toothed appendages, which may be designated as the inner and outer *malellæ*. The inner stipes (*stipes interior*), are united firmly, and are supported behind by what Meinert designates as the *lamina labialis*, behind which is a curved, broad sclerite called by Meinert the hypostoma ; a rather unfortunate name, as it has been used by Meigen and Bouché for the clypeus of Diptera. Differentiated from the front edge of the inner stipes, is a piece usually separated by suture, which, as we understand it, is the *stilus lingualis* of Meinert ; it is our *malulella*. A median portion of the deutomala has been apparently overlooked by authors ; it is our *labiella* (fig. 2), and corresponds in a degree to the lingua of hexapods ; it is a minute rounded piece situated between the malulellæ ; in Julus minute and single ; in the Lysiopetalidæ much larger, and divided into a large anterior, and a much smaller posterior crescent-shaped part ; it is supported by two long cylindrical divaricating styles.

It thus appears that the head of Chilognaths bears but three pairs of appendages, viz., the antennæ, and the mouth-appendages, the proto and deutomalæ. Without doubt the Chilognaths, as proved by their embryology and morphology, and their close relationship with the Pauropoda, the simplest Myriopods, represent the primary form of the Myriopods, while the Chilopods are a secondary, less primitive group. Palæontology apparently supports this view. We may now turn to the structure of the head of Chilopod Myriopoda, which has been fully described by Newport,* and also by Meinert.†

Having already briefly described the morphology of the epicranium or antennal segment of Chilopods, with the labrum and "mandibles" (protomalæ = "true maxillæ" of Newport), which are close homologues of those of diplopod myriopods, we may next take up the second pair of mouth-appendages, which are the morphological equivalents of the so-called labium of Chilognaths. These, as seen in Scolopendra, are very different

* Monograph of the class Myriopoda, Order Chilopoda; with Observations on the general arrangement of the Articulata. By George Newport, Trans. Linn. Soc., xix, p. 287.

† Myriapoda Musæi Hauniensis Bidrag til Myriapodernes Morphologi og Systematik ved Fr. Meinert. Af Naturhistorisk Tidsskrift, 3 R. 7 B., 1871.

from the so-called under lip of Chilognaths; they are not united, and are separate, cylindrical, fleshy, 5-jointed appendages, but as Newport states "connected transversely at their base with a pair of soft appendages (*c*, *c*), that are situated between them, and which, as I have already stated, I regard as the proper *lingua*, as they form the floor of the entrance to the pharynx." These 5-jointed appendages are Mr. Newport's "maxillary palpi;" his true maxillæ being the homologues of the "mandibles" of Chilognaths.

The portion of the head of Scolopendra and other Chilopods, thus far considered, together with the antennæ and proto and deutomalæ, we consider as homologous with the entire head of Chilognaths; the basilar segment of Newport, and the two pairs of head-appendages have no homologues in the head of Chilognaths. They are rather analogous to the maxillipedes of Crustacea, and nothing like them, speaking morphologically, exist in other Tracheata. We therefore propose the term *malipedes* (*mala*, jaw; *pes*, foot, or jaw-feet) for the fourth and fifth pair of cephalic appendages of Chilopoda. At the same time it is easy to see that they are modified feet; especially when we examine the last pair in Scolopendra, which are attached to a true sternite, and see that they are directly homologous with the feet and sternite of the same animal.

The first pair of malipedes are the "labium and palpi" of Newport; the "first auxiliary lip" of Savigny. They, however, bear little resemblance to an insect's labium and labial palpi. They are separate, not coalescing in the middle as in the labium of Hexapods. The so-called labial palpi are 4-jointed, with an accessory plate. They arise directly in front of the "basilar segment" of Newport, but appear to have in adult life no tergite of their own.*

The second pair of malipedes or last pair of mouth-appendages, are the poison fangs; they are the "second auxillary lip" of Savigny; the "mandibles or foot-jaws" of Newport and subsequent authors. The dorsal plate, or what may be called the *second malipedal tergite* is the "basilar and subbasilar plate" of Newport.

As to the number of segments in the head of Chilognaths, both morphology and embryology prove that there are but three; in the Chilopoda five. Newport's observation on the young recently hatched Geophilus (his Pl. xxxiii, fig. 3), shows that the sub-basilar plate is the tergum or scute of the fifth segment; and the basilar plate is consequently the tergum of the fourth segment, or second malipedal segment. The sternite of the sub-basilar plate is usually a very large plate, deeply indented in front in the middle, with teeth on each side, and forms the "labium" of Newport. It may for convenience in descriptive zoölogy be termed the "pseudolabium."

* Balfour also states, as we find after writing the above, that the basilar plate is really the segment of the poison claws, and may fuse more or less completely with the segment in front and behind it, and the latter is sometimes without a pair of appendages (Lithobius, Scutigera) Comp. Embryology, i, p. 225.

PROC. AMER. PHILOS. SOC. XXI. 114. Z. PRINTED SEPTEMBER 17, 1883.

As embryological proofs of our morphological views may be taken the admirable researches of Metschnikoff* on the development of Geophilus. His Taf. xx, fig. 4, shows plainly the four pairs of mouth-appendages behind the antennæ, the latter developed as in Hexapods from the procephalic lobes. His fig. 15 shows that the pleurum and tergum of two posterior (or fourth and fifth) cephalic arthromeres, with their appendages, are the primitive scuta of the proto and dentomalar arthromeres which at this period have coalesced, and are intimately united with the procephalic lobes. His fig. 18 shows that at a later period the primitive scuta of the fourth cephalic segment has disappeared, or at least is merged into the fifth primitive scuta or sub-basilar plate of the adult. An examination of Metschnikoff's paper will prove conclusively that Newport's views as to the sub-segments of the chilopods are not well founded in nature; and that they are merely for the most part simply adult superficial markings.

The following table will serve to indicate, in a comparative way, the number of arthromeres in the head of the three sub-classes of Tracheate arthropods, their corresponding appendages, and the more important synonyms:

	Hexapoda.	Arachnida.	Myriopoda. (Chilopoda.)	Myriopoda. (Chilognatha.)
1st Arthromere (Preoral)	Antennæ.	Wanting.†	Antennæ.	Antennæ.
2d Arthromere (Postoral)	Mandibula.	Cheliceræ.‡ (Mandibles.)	Protomalæ. (Mandibles Savigny.)	Protomalæ. (Mandibles Savigny.)
3d Arthromere	1st Maxillæ.	(Pedipalpi, maxillæ.)	Deutomalæ. (1st Maxillæ Savigny.)	Deutomalæ. (Labium.)
4th " ..	2d Maxillæ.	1st pair of bænopoda.	1st Malipedes. (1st Auxiliary lip, Savigny.)	2d pair of Pedes.
5th " ..	.....	2d pair of bænopoda.	2d Malipedes. (Auxiliary lip, Savigny; Mandibles.)	2d pair of Pedes.
6th " ..	1st pair of bænopoda.	3d pair of bænopoda.	1st pair of Pedes	3d pair of Pedes.

General Morphology of the Body. The well-known researches of Newport on the development of Julus, and the embryological studies of Metschnikoff already referred to, show that the larva of Julus and other diplopod myriopods is hatched with but three pairs of feet. In *Julus terrestris*, as stated by Newport, the 3d body-segment is apodous; the 1st, 2d and 4th segments behind the head bearing feet. The number of body-segments are at first 9; the new segments appearing six at a time. In Strongy-

* Embryologisches, über Geophilus. Von Elias Metschnikoff. Zeitschrift für Wissenschaft. Zoölogie, xxv, p. 313, 1875.

† Balfour claims that the 1st pair of cephalic apppendages are wanting; and the fact shown by his Fig. 200 C, D, that the stomodæum at first lies between the procephalic lobes, and that the latter do not even bear appendages appears to prove his statement.

‡ On the Organs of Reproduction and the Development of the Myriopoda Phil. Trans., 1841.

losoma, according to Metschnikoff, the larva has eight segments behind the head, the second segment footless ; in Polydesmus there are but seven body-segments, the second apparently being apodous, though it is difficult to determine with certainty from the drawing which of the three first segments is apodous.

In two embryos of *Julus multistriatus* Walsh? kindly communicated to us by Prof. Riley, and which he assures us were freshly hatched right from the egg, the larvæ are much more advanced than in the freshly-hatched larvæ referred to ; still *the second body-segment is footless instead of the third;* but there are seventeen segments, the 1st, 3d and 4th each bearing a single pair of legs ; the 5th–10th segments each bearing two pairs of legs. In one of the three specimens, which was apparently a little longer out of the egg than the two others, there were five penultimate short secondary segments (11th–15th) on which there were rudiments apparently of but a *single pair of legs* to each segment, whereas Newport states that two pairs bud out from each segment, and while in *Julus terrestris* the new segments arise in sixes, in our species they arise in fives. In adult life a single pair of limbs arises from the second segment, and the first three segments each have but one pair of legs, the fourth having two as in the fifth and following segments.

It thus appears that the larval diplopod Myriopod is a six-footed Tracheate, though neither its mouth-parts nor primary legs are directly homologous with those of the Hexapodous insects.

Looking at the embryo diplopod Myriopod from a deductive or speculative point of view, it doubtless represents or is nearly allied to what was the primitive myriopodous type, a Tracheate, with a cylindrical body, whose head, clearly separated from the hind body, was composed of three cephalic segments, one pair of antennæ, succeeded by two postoral arthromeres, the protomalal and deutomalal arthromeres ; while the hind body consisted of as few as seven arthromeres, whose scuta nearly met beneath, with three pairs of six-jointed legs distributed among the first four segments. It is evident that the form represented by the adult is a secondary later product, and arose by adaptation to its present form. The embryo Geophilus, the only Chilopod whose embryology has been studied, leaves the egg in the form of the adult ; it has, unlike the diplopods, no metamorphosis. Its embryological history is condensed, abbreviated.

But in examining Metschnikoff's sketches, primitive Chilognath characters assert themselves ; the body of the embryo shortly before hatching is cylindrical ; the sternal region is much narrower than in the adult, hence the insertion of the feet are nearer together, while the first six pairs of appendages (the sixth apparently the first pair of feet of the adult) are indicated before the hinder ones. These features indicate that the Chilopoda probably arose from a diplopod or diplopod-like ancestor, with a cylindrical body, narrow sternites and with three pairs of legs, which represent those of the larval Chilognaths, the two anterior becoming the two pairs of malipedes of the present Chilopoda. Thus the first six appendages of the

embryo Geophilus correspond to the antennæ, two pairs of mouth-parts and three pairs of legs of the larval Julus.

The phenomenon of two pairs of limbs to a segment, so unique in Tracheata, may be explained by reference to the Phyllopoda among the Branchiata. The parallel is quite exact. The larvæ in both groups have but a single pair of appendages to a segment; the acquisition of a second pair in the diplopods is clearly enough a secondary character, and perhaps necessary in locomotion in a cylindrical body with no sterna.*

The larval Julus and the ancestral Chilognaths were hexapod Tracheata, but sufficiently different to indicate plainly that the Myriopods branched off from a much more primitive form than the Scolopendrella-like hexapod ancestor, and which form somewhat agrees with our hypothetical leptiform ancestor of all Tracheata.

The Myriopods also differ from Hexapoda in that the genital armature of the male (the females have nothing corresponding to the ovipositor of Hexapoda) is not homologous with that of true insects; moreover, the armature is not homologous with the limbs or jointed appendages of the myriopodous body. On the contrary, the apparatus of hooks arises from the sternum of the sixth segment, between, but a little in advance of the origin of the eighth pair of legs. It should be observed that the legs in Myriopods are outgrowths between the tergites and sternites, there being no pleurites differentiated, and in this important point also, the myriopods are quite unlike the Hexapodous Tracheates.

Affinity and systematic position of the Pauropoda. The nearest living forms which approaches the larval Diplopod are Pauropus and Eurypauropus. These organisms are practically primitive diplopods. Looking at the lowest Chilognath, *Polyxenus*, and comparing Pauropus with it, it will be seen that the latter scarcely differs from it ordinally. Pauropus has a head with a pair of antennæ and two pair of mouth-appendages, The antennæ are quite unlike any other myriopods, being 5-jointed and bifurcate, somewhat as in certain Coleopterous larvæ; the peculiar sense-filaments may be the homologues of the flattened sense-setæ at the end of the antennæ of Diplopod Myriopods.

The "mandibles" are rudimentary, very simple, and are scarcely more like Chilopod than diplopod protomalæ; there is a second pair of appendages which, as Lubbock states, are "minute and conical;" they bear a closer resemblance in position and general appearance to the "under lip" of Chilognaths, especially the under lip of Siphonophora; in fact, the

* It is plain that, as Balfour suggests, Comparative Embryology p. 324, the double segments have not originated from a fusion of two primitively distinct segments. There is, however, a misconception as to the nature of the "double segments." They are not so in fact. The scutes are single, undivided, but the ventral region is alone imperfectly double, bearing two pairs of appendages, just as single segments of Apodidæ may bear from 2-6 appendages; the differentiation is confined to the ventral limb-bearing region and limbs alone; the dorsal part of the segment does not share in the process.

mouth-appendages of Pauropus are much nearer the normal type of those of the true Chilognaths than the degraded mouth-organs of the Sugentia.

The body of Pauropus is cylindrical, the scutes are as much like those of Polyxenus as those of the Chilopods; the number of body segments is seven, the same as in the larvæ of certain Diplopods; the feet are 6-jointed as in Diplopods, and there are nine pairs, six pairs to the four penultimate segments. The three anterior pairs are developed from two segments, *i. e.*, arise from the ventral and lateral sclerites corresponding to two scutes. This fact should not, we venture to suggest, exclude them from the Chilognaths, as there is a considerable irregularity in the positions of the three pairs of anterior feet in larval Chilognaths. The terminal body-segment is much as in Chilognaths. When we examine the larva of Pauropus, we find a strong resemblance to the larval hexapodous Chilognaths. Hence we scarcely see good grounds for placing Pauropus in a distinct order from Chilognaths. Their distinctive characters, and they are important ones, are we submit. only of subordinate value, and we should therefore place the Pauropoda as the second sub order of Chilognaths, throwing all the genuine Chilognaths into a first sub-order.

Turning to Eurypauropus, we find that this singular form is in a degree a connecting link between Pauropus and Polyxenus; the head has much the same shape, the antennæ being inserted beneath far back from the front edge of the broad top; the legs are much the same shape, and more truly diplopod than in Pauropus, as they are arranged nearly in two pairs to a segment; there are six segments, four of them bearing legs, there being nine pairs of legs to four scuta. The scutes are much as in Polyxenus, spreading out flat on the sides, the animal being elliptical oblong, broad and flat. There are no true sternites like those of Chilopods, and though the feet are inserted wider apart, the entire structure of the soft, membranous sternal region is much as in Polyxenus. We therefore feel warranted, although originally accepting the ordinal rank of the Pauropoda, assigned them by Sir John Lubbock, in regarding them as Chilognaths, with aberrant features which would throw them into a suborder of the latter group.

The Systematic Position of Scolopendrella. This singular form is usually regarded as a Myriopod, while Mr. Ryder refers it to a distinct order, *Symphyla*. We have already* given our reasons for the view that it is a Thysanuran,† with only superficial resemblances to the Chilopod Myriopods. Our fresh studies on the latter confirm our opinion that the Scolopendrella is a hexapod. The mandibles and maxillæ, the former especially, are like those of the Thysanura, rather than the myriopods, not being divided into two parts (stipes and cardo). It seems to us that Scolopendrella with its numerous postcephalic legs may fulfill the

* American Naturalist, xv, 698, Sept. 1881.

† Compare the excellent figures of the mouth-parts of Scolopendrella in Dr. I. Muhr, Die Mundtheile in Scolopendrella und Polyzonium, 10er Jahresbericht über das Deutsche Staats Gymnasium in Prag-Altstadt, 1881-2. Prag. 1882.

phylogenic requirements of the early embryo of Hexapoda and Arachnida in which there are a number of embryonic primitive abdominal appendages. Thus it preceded Campodea as a stem-form.

Genealogy of the Myriopoda. The pseudo-hexapodous larval forms of Chilognatha, including the Pauropoda and the early germ of the Chilopoda (Geophilus), indicate that the many-legged adults were derived from what we have called a Leptus-form ancestor. Our present knowledge of the embryology of the Myriopoda shows that unlike the Arachnida and Hexapoda the embryo is not provided with primitive, transitory legs. There seems then no direct proof that the Myriopoda had an origin common with that of insects and arachnida, from a Scolopendrella-like, and perhaps still earlier Peripatus-like ancestor; but from a six-legged form, which, however, may have been derived from some worm-like ancestor. The Leptus-form larva of Myriopoda, with their three pairs of cephalic appendages and six legs, may, then, be the genealogical equivalent of the six-legged Nauplius of Crustacea; which type is generally believed to have originated from the worms.

A genealogical tree of the Myriopods would then be simply two branches, one representing the diplopod and the other the single paired type (Chilopoda), both originating from a Leptus-like six-footed ancestor (*i. e.*, with three pairs of cephalic and three pairs of postcephalic appendages).

Dr. Erich Haase in his "Beitrag zur Phylogenie und Ontogenie der Chilopoden" publishes a "stammbaum der Protochilopoden." He proposes a hypothetical group, Protosymphyla, from which the Symphyla, Thysanura and Chilopoda have originated. But, as we have seen, this view is based on mistaken views as to the relations of the Chilopods to the diplopod Myriopods, and of the homologies of Myriopods with insects. As we have seen, the Chilopods must have originated from a Chilognathous stock, or at least from a branch which arose from Pauropus-like forms, and the Thysanura, with Scolopendrella, must have arisen from a separate main branch, which led to the Hexapodous branch of the Arthropod genealogical tree.

For the reason stated, also, we should disagree with the views of Haeckel (Naturliche Schöpfungsgeschichte, 1870, 2d edit.) that the Diplopod Myriopods were derived from the Chilopoda. In the English transaction (1876) he remarks. "But these animals also originally developed out of a six-legged form of Tracheata, as is distinctly proved by the individual development of the millipede in the egg. Their embryos have at first only three pairs of legs, like genuine insects, and only at a later period do the posterior pairs of legs bud, one by one, from the growing rings of the hinder body. Of the two orders of Centipedes * * * * the round *double-footed* ones (Diplopoda), probably did not develop until a later period out of the older flat, *single-footed* ones (Chilopoda), by successive pairs of rings of the body uniting together. Fossil remains of the Chilopoda are first mentioned in the Jura period." The Chilognaths, however, as shown by Daw-

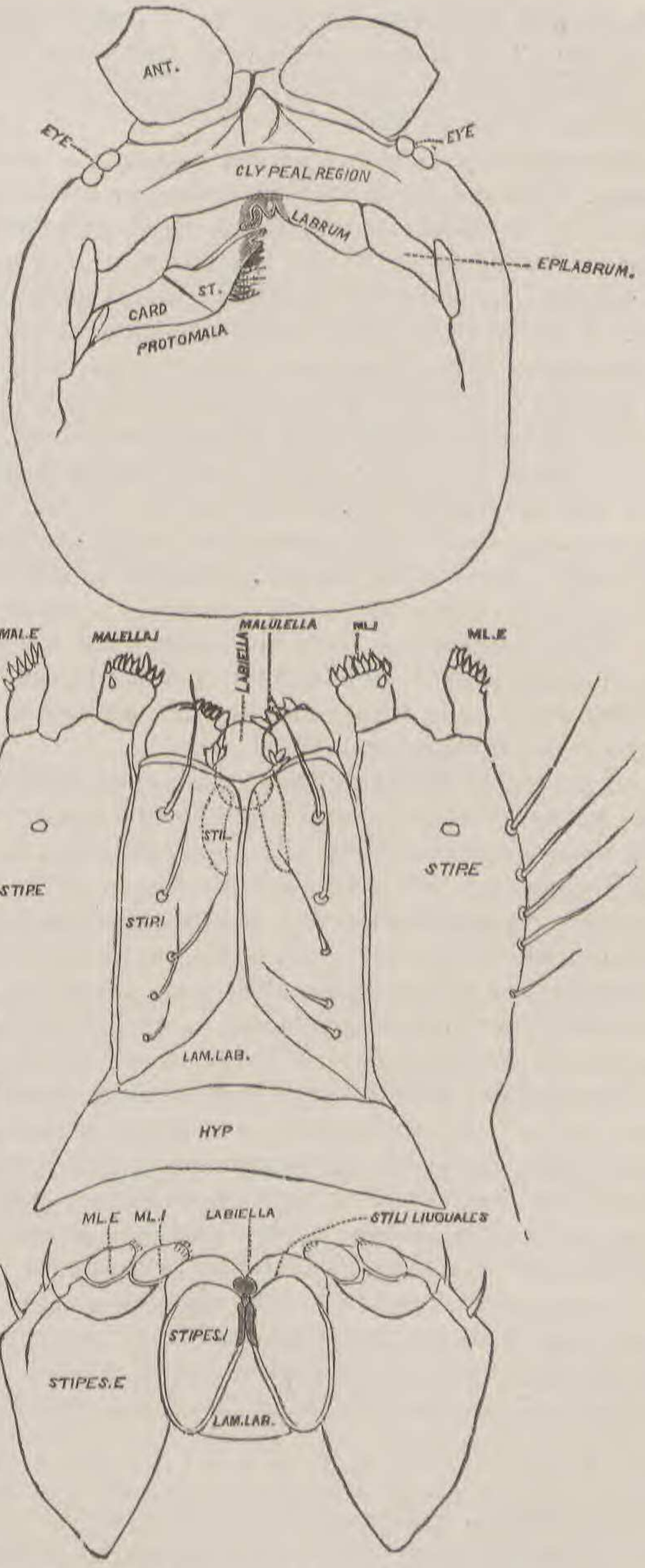

Fig.1.

Fig.2.

Fig.3.

MOUTH-PARTS OF MYRIOPODS.

son, Meek and Worthen, and lately by Scudder, were numerous as far back as the Carboniferous period ; the Chilopods are the later productions ; perhaps not older than the Tertiary period, since Munster's *Geophilus pravus* is a doubtful form.

In this connection, reference should be made to the singular fossil, Palæocampa, from the Carboniferous formation of Illinois, originally described as a caterpillar-like form by Meek and Worthen, and lately claimed to be a Myriopod by Mr. Scudder,* who proposes for the hypothetical groups, of which he considers it as the type, the name, *Protosyngnatha.* It seems to us, after a careful reading of Mr. Scudder's article, that this obscure fossil presents no features really peculiar to the Myriopods ; but that there are as good or better reasons for regarding it as the hairy larva of some Carboniferous neuropterous insect. Mr. Scudder describes it substantially thus : "It is a caterpillar-like, segmented creature, three or four centimeters long, composed of ten similar and equal segments, besides a small head ; each of the segments, excepting the head, bears a single pair of stout, clumsy, subfusiform, bluntly-pointed legs, as long as the width of the body, and apparently composed of several equal joints. Each segment also bears four cylindrical but spreading bunches of very densely packed, stiff, slender, bluntly tipped, rod-like spines, a little longer than the legs. The bunches are seated on mammillæ and arranged in dorsopleural and lateral rows."

We do not recognize in this description any characters of a myriopodous nature ; on the contrary, in what is said about the head, "composed of only a single apparent segment" (p. 165), and of the legs in the above description, and again on p. 165, where it is remarked : "The legs were different in form [from modern Chilopoda], but their poor preservation in the only specimen in which they have been seen, prevents anything more than the mere statement of the following difference ; while the legs of Chilopoda are invariably horny, slender, adapted to wide extension and rapid movement, those of Palæocampa are fleshy, or at best subcoriaceous, very stout and conical, certainly incapable of rapid movement, and serving rather as props," the author appears to be describing rather a caterpillar-like form than a Myriopod. It seems to us that the larvæ of the neuropterous *Panorpidæ*, with their two-jointed abdominal prop-legs, small head and singularly large spinose spines, arising in groups from a tubercle or mammilla, come nearer to Palæocampa than any Myriopod with which science is at present acquainted. For these reasons, and while the nature of these fossils is so problematical, we should exclude them, as regards the Myriopods, from any genealogical considerations.

We have also attempted to show that the *Archypolypoda* † are a subdi-

* The Affinities of Palæocampa Meek and Worthen, as evidence of the wide diversity of type in the earliest known Myriopods, by Samuel H. Scudder. Amer. Journ. Science, xxiv, No. 141, p. 161, Sept., 1882.

† The Systematic Positions of the Archipolypoda, a Group of Fossil Myriopods. Amer. Naturalist, 326, March, 1883.

vision of Chilognaths, allied not remotely to the Lysiopetalidæ; or at least that they are true diplopod Myriopods. Hence we are still reduced for our materials for a phylogeny of the Myriopods to existing orders, Pauropus being, perhaps, a more aberrant and stranger type than any fossil forms yet discovered.

EXPLANATION OF THE FIGURES.

Fig. 1. Head of Scolopendra, seen from beneath, showing the "mandible" (*protomala*) with its cardo (*card.*) and stipes (*sti.*), also the labrum and epilabrum.

Fig. 2. So-called under lip or deutomala of *Scoterpes copei*; *hyp.*, "hypostoma;" *lam. lab.*, lamina labialis; *stip. e.*, stipes exterior; with the *malella exterior* (*mal. e.*) and *malella interior* (*ml. i.*); the *stipes interior* (*stip. i.*), with its malulella; and the *labiella*, with its stilus (*stil.*).

Fig. 3. The deutomala of *Julus* sp.; the lettering as in Fig. 2. Author del.

Stated Meeting, May 18, 1883.

Present, 9 members.

President, Mr. FRALEY, in the Chair.

Dr. Heilprin, a newly-elected member, was introduced to the presiding officer, and took his seat.

A letter requesting a renewal of correspondence was received from the Egyptian Institute.

Letters of acknowledgment were received from the Royal Societies at Amsterdam and Munich.

Letters of envoy were received from the Egyptian Institute, and the Royal Academy at Munich.

Letters requesting No. 95 from the Manchester Literary and Philosophical Society, April 26; and requesting 102, 103, 104, from the Philadelphia College of Pharmacy, April 20, were read and referred.

Donations were received from the Egyptian Institute; Central Observatory at St. Petersburg; Royal Geological Insti-